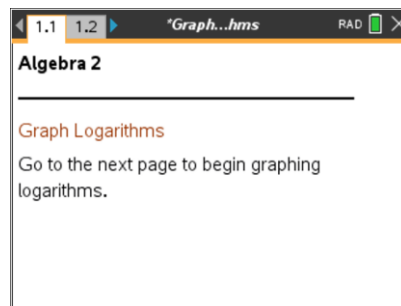# Graph Logarithms
Student Activity

Name _____

Class _____

Open the TI-Nspire document *Graph_Logarithms.tns.*

This activity explores the family of logarithmic functions, $f(x) = \log_a x$ where **a** > 0 and **a** ≠ 1. You will investigate the graphs of logarithmic functions and examine their general characteristics, such as end behavior, domain, and range.

Move to page 1.2.

Press ⌈ctrl⌉ ▶ and ⌈ctrl⌉ ◀ to navigate through the lesson.

1. Explore several different **a**-values by clicking Δ or ∇.

    a. Set **a** = 1. Describe the graph.

    b. By definition, for the logarithmic function $f(x) = \log_a(x)$, **a** cannot equal 1. What mathematical reason can you give for this restriction?

    c. Set **a** = 0. Describe the graph.

    d. By definition, for the logarithmic function $f(x) = \log_a(x)$, **a** cannot equal 0. What mathematical reason can you give for this restriction?

2. Explore several different **a**-values by clicking Δ or ∇.

    a. For what **a**-values is the function increasing? Why?

    b. For what **a**-values is the function decreasing? Why?

3. Explore several different *a*-values by clicking Δ or ∇.

   a. For each **a**-value, identify the *x*-intercept of the function. Interpret your results.

   b. When **a** > 0, why is there no *y*-intercept?

   c. For each **a**-value, what part of point *P* remains the same? Interpret your results.

4. Explore several different *a*-values by clicking Δ or ∇, such that **a** > 1.

   a. What does **f**(*x*) approach as *x* approaches ∞? Explain.

   b. What does **f**(*x*) approach as *x* approaches 0? Explain.

   c. What is the equation of the vertical asymptote?

5. Explore several different **a**-values by clicking Δ or ∇, such that 0 < **a** < 1.

   a. What does **f**(*x*) approach as *x* approaches ∞? Explain.

   b. What does **f**(*x*) approach as *x* approaches 0? Explain.

   c. What is the equation of the vertical asymptote?

6. Find the domain and range for the family of logarithmic functions $f(x) = \log_a x$ where **a** > 0 and **a** ≠ 1.

7. Gail believes $f(x) = \log_a x$ will eventually intersect the *y*-axis. Is she correct? Why or why not?

8. Judy believes $f(x) = \log_a x$ has a horizontal asymptote. Is she correct? Why or why not?